In The Written Description

Applicant respectfully submits a substitute specification and abstract, pursuant to 37 C.F.R. §1.121(b)(3). Please delete the pending specification and abstract pursuant to 37 C.F.R. §1.121(b)(3)(i).

In accordance with 37 C.F.R. §1.121(f), Applicant affirms that the substitute specification does not include any new matter and is submitted only to more accurately describe the invention.

To fulfill the requirements of 37 C.F.R. §1.125(c), Applicant submits a mark-to-show copy of the substitute written description and abstract (as compared to the written description and abstract as amended on August 2, 2004) which shows the matter being added thereto and deleted therefrom, attached hereto as Appendix A ("Mark-to-Show Specification and Abstract"), and a clean version of the amended written description and abstract, attached hereto as Appendix B ("Substitute Written Description and Abstract"). Additionally, for the Examiner's convenience, please find attached a copy of the pending specification and abstract as Appendix C as previously amended ("Original Copy of Specification and Abstract").

In the Claims

This listing of claims, as required by 37 C.F.R. §1.121(c), replaces all prior versions of claims in the application. The 20 originally-filed claims have been cancelled in the Reply to Office Action filed August 02, 2004.

Claims 21-65 were added in that Reply and are pending. Claims 21, 37, and 51 are amended to address the 35 U.S.C. §112, second paragraph rejection; claims 21 and 37 are amended to traverse the 35 U.S.C. §103(a) rejection; claims 26-30 and 42-46 are amended only to change the claim from which they depend; and claims 25 and 41 are cancelled without prejudice. Specifically, claims 21 and 37 are amended to incorporate the limitations of claims 25 and 41, respectively, which were only objected to, i.e., allowable if re-written in independent form.

For the examiner's convenience, a clean version of the claims is attached hereto as Appendix D ("Clean Version of Claims").

What is claimed is:

1-20 (cancelled)

21. (currently amended) A valve assembly comprising:

a solenoid coil adapted to generate a magnetic flux, and having a longitudinal axis and a bore coaxial therewith;

an axially translatable armature made of a magnetic material, said armature supported within an armature cavity for axial translation along said longitudinal axis;

a magnetic pole piece disposed within said bore of said solenoid coil, said magnetic pole piece having a lower distal end and being magnetically coupled to said armature and forming an axial air gap and a radial air gap between said armature and said lower distal end of said magnetic pole piece, said magnetic pole piece further comprised of a sleeve piece portion and an axial portion, said sleeve piece portion further comprised of a relatively thin portion contiguous with said sleeve piece portion, said relatively thin portion rapidly saturating when said valve assembly is subject to said magnetic flux and being magnetically coupled to said armature;

a valve unit, mechanically coupled to said armature, said valve unit having an interior valve poppet cavity in fluid communication with a fluid inlet port to which fluid is applied at a first fluid pressure and a fluid exit port from which said fluid is output at a second fluid pressure and containing a valve seat therebetween, said valve seat adapted to be closed by a valve

closing assembly comprised of a valve poppet mechanically coupled to said armature, so as to regulate fluid flow between said fluid inlet port and said fluid exit port;

an armature centering mechanism to prevent off-axis tilting of said armature; and

a fluid pressure balancing arrangement adapted to compensate for said first fluid pressure and said second fluid pressure being exerted against said valve poppet, said fluid pressure balancing arrangement comprising a diaphragm between said ~~upper~~ armature cavity and said interior valve poppet cavity and a fluid communication path through said valve closing assembly, said fluid communication path providing fluid communication between said fluid exit port and said ~~upper~~ armature cavity.

22. (previously presented) The valve assembly according to claim 21, wherein said valve poppet further comprises a sealing ring disposed on a poppet face of said valve poppet to form a fluid-tight seal between said valve poppet and said valve seat in a manner that prevents fluid communication between said fluid inlet port and said fluid exit port.

23. (previously presented) The valve assembly according to claim 21, wherein said armature is further comprised of a ferrule-shaped projection, said ferrule shaped projection of said armature forming said radial air gap between said magnetic pole piece and said armature.

24. (previously presented) The valve assembly according to claim 21, wherein said lower distal end of said magnetic pole piece is further comprised of a

ferrule-shaped projection, said ferrule-shaped projection forming said radial air gap between said magnetic pole piece and said armature.

25. (cancelled) ~~The valve assembly according to claim 21, wherein said magnetic pole piece is comprised of a sleeve piece portion and an axial portion, said sleeve piece portion further comprised of a relatively thin portion contiguous with said sleeve piece portion, said relatively thin portion rapidly saturating when said valve is subject to said magnetic flux and being magnetically coupled to said armature.~~

26. (currently amended) The valve assembly according to claim ~~25~~ 21, wherein said sleeve pole piece portion and said relatively thin portion of said magnetic pole piece are solid with a lower portion of said magnetic pole piece so that support for and axial alignment of said lower distal end of said magnetic pole piece relative to said armature is provided by said relatively thin portion and said sleeve pole piece portion of said magnetic pole piece continuous therewith, and is exclusive of a non-magnetic element.

27. (currently amended) The valve assembly according to claim ~~25~~ 21, wherein said relatively thin portion, said sleeve piece portion, and said lower portion of said magnetic pole piece are adapted to receive said solenoid coil.

28. (currently amended) The valve assembly according to claim ~~25~~ 21, wherein said sleeve piece portion of said magnetic pole piece further includes a radially inwardly projecting portion that is adjacent to, but radially spaced apart from, and magnetically coupled to said armature.

29. (currently amended) The valve assembly according to claim ~~25~~ 21, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are configured to be one integral component.

30. (currently amended) The valve assembly according to claim ~~25~~ 21, wherein said axial portion of said magnetic pole piece is axially adjustable relative to said sleeve piece portion and said relatively thin portion of said magnetic pole piece.

31. (previously presented) The valve assembly according to claim 30, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are provided with a fluid seal therebetween.

32. (previously presented) The valve assembly according to claim 21, wherein said assembly further includes a biasing member disposed substantially within said bore of said solenoid coil and between said magnetic pole piece and said armature for biasing said armature away from said lower distal end of said magnetic pole piece.

33. (previously presented) The solenoid-actuated valve assembly according to claim 32, wherein said biasing member is a spring.

34. (previously presented) The valve assembly according to claim 21, wherein said diaphragm has an annular area substantially the same as an annular area of said valve seat.

35. (previously presented) The valve assembly according to claim 21, wherein said armature centering mechanism is a pair of spiral-configured suspension springs.

36. (previously presented) The valve assembly according to claim 21, wherein said valve assembly further comprises an O-ring to prevent fluid leakage between said valve unit and said armature cavity.

37. (currently amended) A solenoid-actuated valve assembly comprising:

a solenoid coil having a longitudinal axis and a solenoid bore coaxial therewith, said solenoid coil producing a magnetic flux;

a magnetic pole piece comprised of an axial portion, a lower distal end, and a sleeve piece portion, said magnetic pole piece supported within said solenoid bore and exclusive of the use of non-magnetic material, said sleeve piece portion further comprised of a relatively thin portion contiguous with said sleeve piece portion, said relatively thin portion rapidly saturating when said valve is subject to said magnetic flux;

an axially translatable armature made of a magnetic material, said armature being supported substantially within an armature cavity for axial translation along said longitudinal axis, said armature forming an axial gap and a radial air gap with said magnetic pole piece, said armature magnetically coupled to said relatively thin portion of said magnetic pole piece, and said armature having an internal bore therethrough providing fluid communication with said solenoid bore;

a valve unit, mechanically coupled to said armature, said valve unit having an interior valve poppet cavity in fluid communication with a fluid inlet port to which fluid is applied at a first fluid pressure and a fluid exit port from which said fluid is output at a second fluid pressure and containing a valve

seat therebetween, said valve seat adapted to be closed by a valve closing assembly comprised of a valve poppet mechanically coupled to said armature, so as to regulate fluid flow between said fluid inlet port and said fluid exit port;

an armature centering mechanism to prevent off-axis tilting of said armature;

a fluid pressure balancing arrangement adapted to compensate for said first fluid pressure and said second fluid pressure being exerted against said valve poppet, said fluid pressure balancing arrangement comprising a diaphragm between said ~~upper~~ armature cavity and said interior valve poppet cavity and a fluid communication path through said valve closing assembly, said fluid communication path providing fluid communication between said fluid exit port and said ~~upper~~ armature cavity; and

a spring disposed substantially within said solenoid bore of said solenoid coil and between said magnetic pole piece and said armature for biasing said armature away from said lower distal end of said magnetic pole piece.

38. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said valve poppet further comprises a sealing ring disposed on a poppet face of said valve poppet to form a fluid-tight seal between said valve poppet and said valve seat in a manner that prevents fluid communication between said fluid inlet port and said fluid exit port.

39. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said armature is further comprised of a ferrule-shaped

projection, said ferrule shaped projection of said armature forming said radial air gap between said magnetic pole piece and said armature.

40. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said lower distal end of said magnetic pole piece is further comprised of a ferrule-shaped projection, said ferrule-shaped projection forming said radial air gap between said magnetic pole piece and said armature.

41. (cancelled) ~~The solenoid-actuated valve assembly according to claim 37, wherein said sleeve piece portion is further comprised of a relatively thin portion contiguous with said sleeve piece portion, said relatively thin portion rapidly saturating when said valve is subject to said magnetic flux and being magnetically coupled to said armature.~~

42. (currently amended) The solenoid-actuated valve assembly according to claim ~~41~~ 37, wherein said sleeve pole piece portion and said relatively thin portion of said magnetic pole piece are solid with a lower portion of said magnetic pole piece so that support for and axial alignment of said lower distal end of said magnetic pole piece relative to said armature is provided by said relatively thin portion and said sleeve pole piece portion of said magnetic pole piece continuous therewith, and is exclusive of a non-magnetic element.

43. (currently amended) The solenoid-actuated valve assembly according to claim ~~41~~ 37, wherein said relatively thin portion, said sleeve piece portion, and said lower portion of said magnetic pole piece are adapted to receive said solenoid coil.

44. (currently amended) The solenoid-actuated valve assembly according to claim ~~41~~ 37, wherein said sleeve piece portion of said magnetic pole piece further includes a radially inwardly projecting portion that is adjacent to, but radially spaced apart from, and magnetically coupled to said armature.

45. (currently amended) The solenoid-actuated valve assembly according to claim ~~41~~ 37, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are configured to be one integral element.

46. (currently amended) The solenoid-actuated valve assembly according to claim ~~41~~ 37, wherein said axial portion of said magnetic pole piece is axially adjustable relative to said sleeve piece portion and said relatively thin portion of said magnetic pole piece.

47. (previously presented) The solenoid-actuated valve assembly according to claim 46, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are provided with a fluid seal therebetween.

48. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said diaphragm has an annular area substantially the same as an annular area of said valve seat.

49. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said armature centering mechanism is a pair of spiral-configured suspension springs.

50. (previously presented) The solenoid-actuated valve assembly according to claim 37, wherein said valve assembly further comprises an O-ring to prevent fluid leakage between said valve unit and said armature cavity.

51. (currently amended) A valve assembly comprising:

a solenoid coil adapted to generate a magnetic flux, and having a longitudinal axis and a bore coaxial therewith;

an axially translatable armature made of a magnetic material, said armature supported within an armature cavity for axial translation along said longitudinal axis;

a magnetic pole piece disposed within said bore of said solenoid coil, said magnetic pole piece comprised of an axial portion, a lower distal end, and a sleeve piece portion, said magnetic pole piece being magnetically coupled to said armature and forming an axial air gap and a radial air gap between said armature and said lower distal end of said magnetic pole piece, and said sleeve piece portion further comprised of a relatively thin portion contiguous with said sleeve piece portion, said relatively thin portion rapidly saturating when said valve is subject to said magnetic flux;

a valve unit, mechanically coupled to said armature, said valve unit having an interior valve poppet cavity in fluid communication with a fluid inlet port to which fluid is applied at a first fluid pressure and a fluid exit port from which said fluid is output at a second fluid pressure and containing a valve seat therebetween, said valve seat adapted to be closed by a valve closing assembly comprised of a valve poppet mechanically coupled to said armature, so as to regulate fluid flow between said fluid inlet port and said fluid exit port;

an armature centering mechanism to prevent off-axis tilting of said armature; and

a fluid pressure balancing arrangement adapted to compensate for said first fluid pressure and said second fluid pressure being exerted against said valve poppet, said fluid pressure balancing arrangement comprising a diaphragm between said ~~upper~~ armature cavity and said interior valve poppet cavity and a fluid communication path through said valve closing assembly, said fluid communication path providing fluid communication between said fluid exit port and said ~~upper~~ armature cavity.

52. (previously presented) The valve assembly according to claim 51, wherein said valve poppet further comprises a sealing ring disposed on a poppet face of said valve poppet to form a fluid-tight seal between said valve poppet and said valve seat in a manner that prevents fluid communication between said fluid inlet port and said fluid exit port.

53. (previously presented) The valve assembly according to claim 51, wherein said armature is further comprised of a ferrule-shaped projection, said ferrule shaped projection of said armature forming said radial air gap between said magnetic pole piece and said armature.

54. (previously presented) The valve assembly according to claim 51, wherein said lower distal end of said magnetic pole piece is further comprised of a ferrule-shaped projection, said ferrule-shaped projection forming said radial air gap between said magnetic pole piece and said armature.

55. (previously presented) The valve assembly according to claim 51, wherein said sleeve pole piece portion and said relatively thin portion of said magnetic pole piece are solid with a lower portion of said magnetic pole piece so that support for and axial alignment of said lower distal end of said magnetic pole piece relative to said armature is provided by said relatively thin portion and said sleeve pole piece portion of said magnetic pole piece continuous therewith, and is exclusive of a non-magnetic element.

56. (previously presented) The valve assembly according to claim 51, wherein said relatively thin portion, said sleeve piece portion, and said lower portion of said magnetic pole piece are adapted to receive said solenoid coil.

57. (previously presented) The valve assembly according to claim 51, wherein said sleeve piece portion of said magnetic pole piece further includes a radially inwardly projecting portion that is adjacent to, but radially spaced apart from, and magnetically coupled to said armature.

58. (previously presented) The valve assembly according to claim 51, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are configured to be one integral component.

59. (previously presented) The valve assembly according to claim 51, wherein said axial portion of said magnetic pole piece is axially adjustable relative to said sleeve piece portion and said relatively thin portion of said magnetic pole piece.

60. (previously presented) The valve assembly according to claim 59, wherein said sleeve piece portion and said axial portion of said magnetic pole piece are provided with a fluid seal therebetween.

61. (previously presented) The valve assembly according to claim 51, wherein said assembly further includes a biasing member disposed substantially within said bore of said solenoid coil and between said magnetic pole piece and said armature for biasing said armature away from said lower distal end of said magnetic pole piece.

62. (previously presented) The solenoid-actuated valve assembly according to claim 61, wherein said biasing member is a spring.

63. (previously presented) The valve assembly according to claim 51, wherein said diaphragm has an annular area substantially the same as an annular area of said valve seat.

64. (previously presented) The valve assembly according to claim 51, wherein said armature centering mechanism is a pair of spiral-configured suspension springs.

65. (previously presented) The valve assembly according to claim 51, wherein said valve assembly further comprises an O-ring to prevent fluid leakage between said valve unit and said armature cavity.